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or contact patricio.saiz@uam.es for further information

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**WHY DID CORPORATIONS PATENT IN SPAIN?
SOME HISTORICAL INQUIRIES**

Patricio Sáiz (UAM)

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**DEPARTAMENTO DE ANÁLISIS ECONÓMICO:
TEORÍA ECONÓMICA E HISTORIA ECONÓMICA**

*Why Did Corporations Patent in Spain: Some Historical Inquiries**

1. Introduction

For the understanding of processes of technology transfer in the twentieth century, we would probably have to begin by scrutinizing them throughout the second half of the nineteenth century, especially if we would like to consider this topic from a global business history perspective. Multinational corporations initiated their expansion, which implied technological and human capital shifts from one nation to another, at least from 1870 onwards, just when the political and entrepreneurial interests related to patent protection also started to become a global issue. The international meetings and agreements in the 1870s and 1880s that led to the International Union for the Protection of Industrial Property, the ancestor of the current WIPO, demonstrated the increasing concern and influence of corporations and networks of agents, employed by the former, in the ongoing process of reaching transnational rights to safeguard new technologies.¹ Recent research on the role of patent and trademark agents in lobbying both national laws and international treaties corroborates that in the late nineteenth century and the first decades of the twentieth century the companies that used their legal services

* This work has been supported by the Collaboration Agreement between the Oficina Española de Patentes y Marcas and the Universidad Autónoma de Madrid for Cataloguing and Studying the Historical Documentation on Patents and Trademarks (1999-2010).

¹ The classical work on the internationalization of patent systems in Edith T. Penrose, The Economics of the International Patent System (Baltimore, 1951). See also Yves Plasseraud and François Savignon, L'Etat et l'invention: histoire des brevets (Paris, 1986), 73-83; and Eda Kranakis, "Patents and Power. European Patent-System Integration in the Context of Globalization", Technology and Culture 48 (2007): 689-728, 694-698.

urgently needed protection for a pressing new business: that of technological globalization.²

On the one hand, governments from pioneer and early follower countries were progressively influenced by industrial firms and economic groups politically well-connected and increasingly interested in obtaining support for the conquest of new external markets at the same time that they demanded protection in the domestic ones. On the other hand, the rulers and entrepreneurs of latecomers and backward nations were also attentive to and fascinated by new machines and innovations that would lead the country to industrialization and sustained economic growth. In these circumstances, the progressive commercial protectionism that took place between the final decades of the nineteenth century and the World War I did not hold technology transfers back, but on the contrary boosted foreign investments, international expansion and industrial growth of corporations, which began to found factories and joint ventures in third countries, as well as the exchanges of scientific and informal knowledge, technical innovations and human capital. That is what we now call the first globalization process, in which firms and “capitalists” undoubtedly were the main actors.

From 1883-1884, when the first twelve countries signed the Paris Convention for the Protection of Industrial Property, to the beginning of World War II in 1939, scores of States had signed the patent and trademark agreements, among them all the most industrialized and developed nations in the western world and their followers.³ Spain was one of the original founding members of the Union and, thus, it compromised

² See Anna Guagnini, “Patent Agents, Legal Advisers and Guglielmo Marconi’s Breakthrough in Wireless Telegraphy”, *History of Technology* 24 (2002): 171-201; Gabriel Galvez-Behar, “Des médiateurs au coeur du système d’innovation: les agents de brevets en France (1870-1914)” in *Les archives de l’invention*, dir. M. S. Corcy, C. Douyère-Demeulenaere and L. Hilaire-Pérez, (Toulouse, 2006), 437-447; and David Pretel, “Global Technologies: Patents and Globalisation in the European Periphery (Spain, 1851-1900)”, (Forthcoming Ph.D. diss., Universidad Autónoma de Madrid, 2011), Chapter 4 on patent agents.

³ For details of countries and joint dates see WIPO, “Industrial Property Treaties Administered by WIPO”, *Industrial Property* January (1994).

by granting the same treatment to foreign-resident patentees as to domestic ones, something that, in practice, had been occurring since the beginning of the system in 1820-26. The Spanish patent Law of 1878 guaranteed two years of priority rights to foreign patents (but limiting them to a 10-year rather than a 20-year extension) something that was standardized after the signing of the 1883 agreement, which demanded only six months of priority rights (one year from 1900 on), and after passing the more modern Law of 1902.⁴ But at the same time that Spanish legal institutions in charge of patent protection apparently adjusted to international standards, providing protection for foreign inventors and especially firms and corporations who began to extend their patent rights throughout Europe, the Spanish legal system was also designed initially to encourage ‘innovation activity’ in addition to ‘invention activity’. The latter was not the most relevant issue for a country distinguished by extreme industrial, scientific and technical backwardness during most of the nineteenth and well into the twentieth century. The Spanish governments were eager for industrialization and economic growth, and promoting foreign technology transfers and imitation was the quickest way to achieve innovations.

Thus, the Spanish patent system was conceived in a rather hybrid manner, both to assure a basic normative framework to attract foreign inventors and innovators who wanted to extend their rights to Spain, as well as to limit that protection if it did not turn into actual innovation and economic growth within the borders. This was implemented by two major means: regulating patents of introduction and, at the same time, establishing compulsory working clauses. The former could be used to protect foreign third-person technologies without their authorization in order to implement them

⁴ A complete explanation of the main legal characteristics of the Spanish patent system and its evolution throughout the nineteenth and twentieth centuries in Patricio Sáiz, “The Spanish Patent System (1770-1907)”, *History of Technology* 24 (2002): 45-79, Section 2.

locally, providing they were not already established in Spain⁵. The latter required nationals and foreigners to put into practice the inventions granted by any patent (in one, two or three years time, depending on the law)⁶ within national territory, otherwise declaring an expiration date and therefore making that technical knowledge public and of free use. Both characteristics were maintained until 1986, upon joining the European Union, and if we add the traditional judiciary weakness in prosecuting fraud against industrial property, which still seems to be a problem if we attend to current international reports on intellectual piracy,⁷ it seems that the Spanish patent system has been rather feeble until recent times.

Commercial policy was the other means of promoting industrialization, first opening the market to direct technology imports from abroad, the principal path of technical advancement in many industries in nineteenth-century Spain, and secondly by the protectionist turn of events from 1877 onwards that was slowly driven to imports substitution. These latter measures activated some changes in the ‘National Innovation System’ between 1880 and 1939 which allowed the acquisition of technological capabilities and the sprouting of the first seeds of domestic scientific and inventive activity⁸, but the main source of innovation was that which was being transferred from abroad. That occurred in several ways: first, direct technological imports were still possible and frequent in some sectors which required complex machinery and

⁵ On patents of introduction see Patricio Sáiz, “Patents of Introduction and the Spanish Innovation System”, *UAM Working Papers on Economic History*, 01 (2010), available at <http://econpapers.repec.org/paper/uamwpapeh/201001.htm>.

⁶ One year between 1826 and 1878, two between 1878 and 1902, and three years from 1902 onwards.

⁷ See the [2009 International Piracy Watch List](#) elaborated by The Congressional International Anti-Piracy Caucus of The United States Congress.

⁸ This was a very interesting period in Spain for Science and Technology. Internationally recognized inventors as Leonardo Torres Quevedo, Isaac Peral or Juan de la Cierva or the first Nobel Prize in Science (Santiago Ramón y Cajal) carried out their work during those years. See José Manuel Sánchez Ron, *Ciencia y sociedad en España de la Ilustración a la Guerra Civil* (Madrid, 1988). Also ed. Jose Manuel Sánchez Ron, *Un siglo de Ciencia en España*, (Madrid, 1998).

equipment (electricity, the chemical industry, etc.)⁹; second, domestic entrepreneurs and firms in sectors favoured by protectionism (textile, mechanics and metal works, etc.), who likely did not care much about promoting inventive activity but needed well-proved techniques from abroad, could use ‘patents of introduction’ to copy and bring in knowledge and/or technicians to build the machines; third, they could also negotiate with foreign companies that patented in Spain, either buying all rights within the country or a work license, or attempting a joint venture. Finally, we must take into account that international protectionism had another significant effect, as it was the growth and expansion of corporations that began businesses and opened factories in other countries, as occurred within Spain¹⁰. Alone or in joint ventures with domestic capital they invested abroad and transferred technologies and knowledge.

In this paper we will explore how international corporations used the Spanish patent system in the late nineteenth century and the first decades of the twentieth century in order to discover what the actual effects of its apparent weakness were. The origins and evolution of corporate patenting in Spain, the effects of compulsory working clauses, the management of assignments, the various strategies followed by the firms, and the effects of patents on technology transfer to the Spanish economy will be clarified. For that we will use a database of 150,000 patents registered in Spain from 1820 to 1940 that we have built during the last ten years from the direct reading of the original documentation (administration files and technical reports) of each and every patent deposited in the Archive of the Spanish Patents and Trademarks Office (OEPM),

⁹ See Concha Betrán, “La transferencia de tecnología en España en el primer tercio del siglo XX: el papel de la industria de bienes de equipo”, *Revista de Historia Industrial*, 15 (1999): 41-81.

¹⁰ A general view of foreign investments in Spain in Teresa Tortella, *A Guide to Sources of Information on Foreign Investment in Spain, 1780-1914* (Amsterdam, 2000).

in the framework of one of the major recent research projects on economic history in Spain¹¹.

2. The evolution of corporate patenting in Spain (1820-1939)

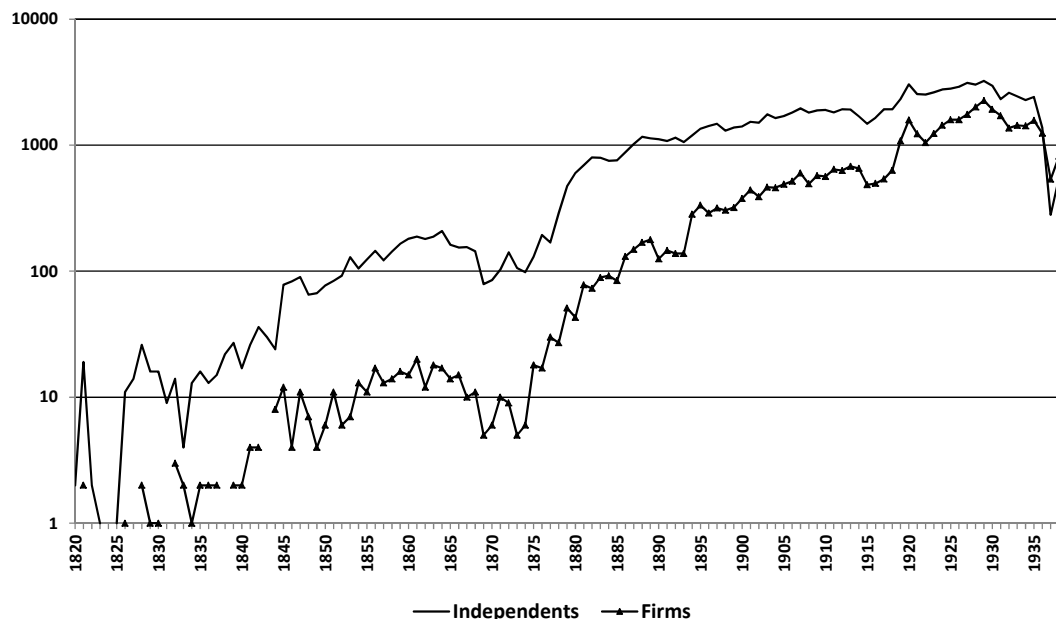
During the nineteenth century, patent systems everywhere went through a progressive shift from being mainly used by individual inventors, skilled artisans, small-scale industrialists and entrepreneurs themselves to being increasingly ‘captured’ by firms and corporations. By the second half of the twentieth century the vast majority of patents and new technologies protected in western economies were already owned by firms which then employed inventors and scientists in their research departments and simply limited their recognition by naming the authors in the patent procedures. The period between 1880 and 1939 was crucial in reversing patent-owning, especially in countries such as the US, Germany, the UK or France¹². Eventually lagging economies followed the same pattern, as far as this first technological globalization took place and corporations from the North Atlantic extended their influence. That was the case of Spain, in which firms progressively increased their presence after 1875-80, coinciding with the Restoration of the monarchy and the normalization of the socio-political and economic situation¹³, and mainly during the final years of the nineteenth century and the 1920s, a decade of exacerbated protectionism and heavy industrialization under Primo de Rivera’s dictatorship, when many foreign corporations arrived in Spain.

¹¹ See the acknowledge note at the beginning. Around 70 people have been involved in this enormous and well-supported project for a decade (see <http://historico.oepm.es> for further details).

¹² See Ian Inkster, *Science and Technology in History. An Approach to Industrial Development* (London, 1991), 160-166. Also John Cantwell and Birgitte Andersen, “A Statistical Analysis of Corporate Technological Leadership Historically”, *Economics of Innovation and New Technology* 4 (1996): 211-234; and Birgitte Andersen, *Technological Change and the Evolution of Corporate Innovation. The Structure of Patenting, 1880-1990* (Cheltenham, 2001), 28-34.

¹³ The Restoration brought about a political and economic period of stability characterized by a new Constitution and new economic regulations as, among others, the Public Works Law (1875), the Railways Law (1877), the Patents Law (1878) or the new Commerce Law (1885). The industrial and agricultural production indexes grew up during those decades, the integration of the national market was completed and the protectionist turn began.

Graph 1. Independent and Corporate Patents. Spain, 1820-1939.*



*Independents: Patents applied by one or more individuals; Firms: Patents applied by firms alone or with individuals.

Source: Archivo Histórico Nacional y Gaceta de Madrid for privileges from 1820 to 1826. Between 1826 and 1939: Original documents of patents at the Oficina Española de Patentes y Marcas.

This can be observed in Graph 1, where the long-term evolution of patents applied for by firms and individuals in Spain is represented. Although general trends of the Spanish patent system have been widely analyzed in previous studies,¹⁴ it is necessary to remember the repercussion of the financial crisis of 1864 and the revolutionary events of 1868, which led to Queen Isabel II's exile, and the aforementioned economic changes brought about by the Restoration after 1876. We must especially refer to the patent law of 1878, which introduced a system of progressive annual quotas that, in practice, supposed an enormous savings in patent rights, since only the first-year fees were required to make it effective. Likewise, the 1883 international agreement on industrial property must be mentioned, as it reinforced

¹⁴ See Patricio Sáiz "The Spanish Patent System..." or Patricio Sáiz, Invencción, patentes e innovación en la España contemporánea, (Madrid, 1999) (free availability in Google Books).

protection for foreign patents. From that time on, there was a continuous increase in applications and grants, both domestic and even more so foreign, in response to the legal and socio-economic improvements. Foreign patent activity was also a response to the general increase of inventions and patents in the world, as statistical evidence and the lineal regressions that we have made in another analysis confirm.¹⁵ Patent growth slowed down at the end of the 1920s, caused in part by the decline of the international economic panorama after the crisis of 1929 and the 1930s recession, which influenced foreign patentees, but mostly by a sharp domestic deterioration in political and social conditions that led to Franco's military coup and to the Spanish Civil War (1936-1939), which entailed a fast economic collapse while patent series dropped off.

This very general trend is correct for any patent distribution we examined, as Graph 1 demonstrates for individuals and firms, but apart from this consistent evolution, the corporations' catching-up process, in the long run, is noteworthy. Individual patentees always stood out in Spain during the entire period studied. Many of them were industrialists, manufacturers, entrepreneurs, traders, etc. closely related to production processes and enterprises,¹⁶ but they, and not the firms, were the true owners of technologies, which made a remarkable difference. Individuals completely predominated before 1880, with an average of 90.1% patents, compared to only 9.9% applied for by firms, the majority of the latter being small family companies with limited partners and only a few being incorporated.¹⁷ Nevertheless, the proportion of individuals constantly decreased from 1880 on, whereas firms and corporations grew,

¹⁵ Edward Beatty and Patricio Saiz, "Propiedad industrial, patentes e inversión en tecnología en España y México (1820-1914)" in *México y España ¿historias económicas paralelas?*, dir. R. Dobado, A. Gómez and G. Márquez, (México D. F., 2007), 425-467, see patenting determinants for foreigners (Table 6) and for domestic (Table 7). 'Foreign patents', calculated as 2-year cumulative sum of patents taken in France, Britain, Germany and the US, demonstrated to be a relevant variable in the regression results for foreigners patenting activity in Spain, as it also was the dummy variable for the patent law of 1878.

¹⁶ See Patricio Sáiz, "The Spanish Patent System...", Table 5.

¹⁷ See Patricio Sáiz, *Inención, patentes e innovación...*, 163-169 for an analysis of these firms before 1880.

especially from 1890 to World War I and in the 1920's, as can be observed in Table 1. From 1890 to 1930, the Spanish economy improved and expanded under intense protectionism and governmental support for 'national' industrial production, which means both domestic and foreign firms installing factories within national territory. Spain benefitted from World War I, first because the increase in value of direct industrial and services exports during the conflict, which yielded enormous profits for firms and entrepreneurs, secondly because of the import-substitution phenomena in times of war, and finally because Spain's neutrality also attracted capital, bank branches, firms and skilled human capital from abroad. These foreign investments, together with national accumulated capital, would play a significant economic role in the industrial expansion (especially of heavy industry) of the 1920s, the decade in which corporate patents rapidly increased.

Table 1. Percentages of Individual and Corporate Patents. Spain, 1880-1939.

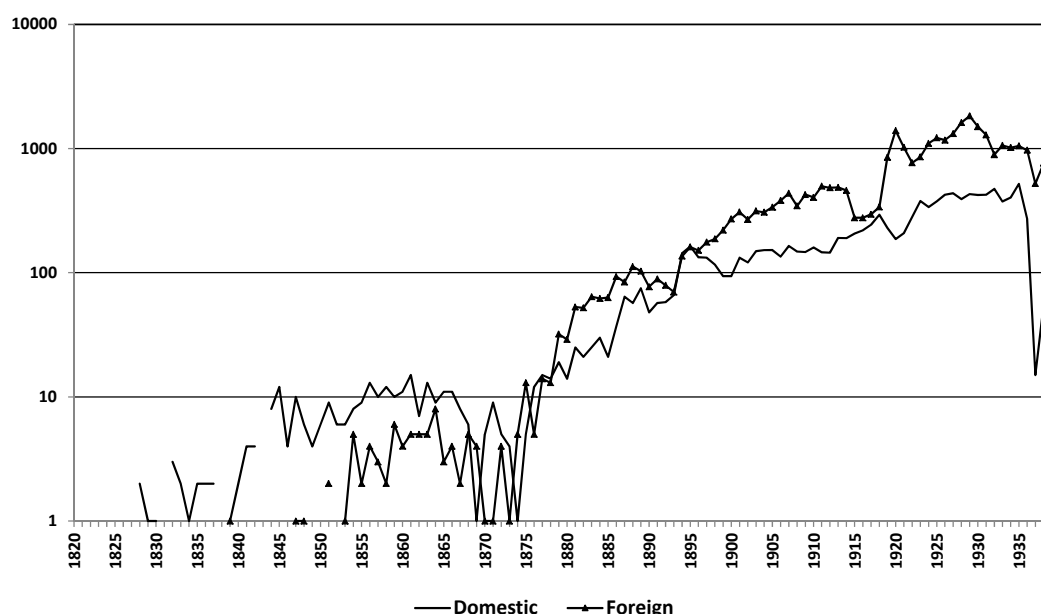
	Individuals %	Firms %	Patents
1880-1889	88.8	11.2	9,681
1890-1899	83.9	16.1	14,913
1900-1909	78.0	22.0	21,811
1910-1919	74.4	25.6	24,965
1920-1929	64.5	35.5	44,338
1930-1939	58.3	41.7	31,284

Source: See Graph 1.

There were two distinct periods in corporate patenting in Spain, both in the propensity to register and in the companies' country of residence. The first period was from 1820 to 1880, when, as we know, individuals predominated and there were only a few firms using the patent system. As Graph 2 demonstrates, the majority of them were Spanish or operated from Spain and hardly any were patents from abroad. But in the second period, from 1880 to 1939, when the number of entrepreneurial patents

increased constantly, that tendency was reversed and foreign companies located outside of Spain increased their rhythm of registering new technologies in the Spanish market to a greater extent than resident firms. Among the latter were a few Spanish subsidiaries of foreign corporations understanding the market in which they were operating perfectly but connected to their parent companies and using complementary strategies of patenting. Nevertheless, although we will offer some data on this phenomenon in the conclusions, herein we will analyze the corporations with foreign addresses (with or without Spanish subsidiaries) that began compulsory patenting in Spain in the late nineteenth century and during the first half of the twentieth century, in order to understand their strategies, the economic consequences for backward countries and the true role in the international theatre of technological globalization.

Graph 2. Corporate patents by firms' residence. Spain, 1820-1939.



Source: See Graph 1.

As Graph 2 shows, foreign companies began to patent in Spain during the 1880s in response to the significant institutional changes, such as the 1878 Law and the

international agreements of 1883, but also due to the progressive tendency to extend patent rights to other countries. The international crisis of the end of the nineteenth century and the consequences of World War I can be clearly noticed. The former affected both domestic and foreign companies but the war impacted the entrepreneurial activity of warring nations. Despite this circumstance, foreign companies intensely increased their applications from the beginning of the twentieth century up until World War I and beyond, during the 1920s, always markedly outnumbering domestic companies. The following sections will examine how this patent colonization was organized and what consequences it had.

3. Foreign Corporations and the Use of the Spanish Patent System

Once two distinct quantitative and qualitative periods have been established, it is necessary to deeply analyze where foreign corporate patents came from in each of these periods and what their long-term evolution was. Before 1880, when Spanish resident firms predominated, there were only 162 patents applied for by non-resident companies. As Table 2 demonstrates, most of them were French (72.2%), which unmistakably leads to a scarcely integrated patent system in which market knowledge, human capital mobility and direct investments in the Spanish economy drove the interest in taking out a patent. In this context, geographic proximity matters greatly, being the final cause of the considerable leadership of French firms and French individuals and businessmen. Spanish patent legislation had been totally influenced by the French revolutionary Patent Law of 1791 and many entrepreneurs, capitalists, technicians and firms had extensively invested in the first Spanish industrialization from 1845 to 1865, which had even led them to establish themselves in Spain and become legal residents. A great quantity of new European technologies (French or not) had poured into the country through their hands and brains, principally in railways, mining and several other sectors.

As we have already demonstrated in other works, 75% of the patents applied for by foreign residents in Spain before 1878 were granted to French individuals and firms.¹⁸ Thus, it is not surprising that firms residing in France were also the main source of corporate patents from abroad. The majority were from Paris and its surroundings and were family companies with limited partners, although the first incorporated firms can also be found, especially in mining, basic metals, mechanical construction, machinery, gas and lighting, etc.¹⁹

Table 2. Foreign Corporate Patents by Firms' Country of Residence. Spain, 1820-1939.

	1820-1939	1820-1879	1880-1899	1900-1919	1920-1939
	%	%	%	%	%
Germany	29.7	11.1	26.9	29.9	30.0
France	19.7	72.2	34.6	22.0	17.1
USA	14.5	1.2	9.4	13.7	15.4
UK	13.7	6.2	11.1	14.9	13.5
Switzerland	6.6	3.1	4.3	4.9	7.4
Netherlands	3.8	0.0	0.4	0.9	5.1
Italy	3.3	3.1	2.4	3.3	3.5
Belgium	2.4	1.2	6.5	3.2	1.7
Sweden	1.6	0.0	0.5	1.4	1.7
Austria	1.0	0.0	1.6	1.7	0.7
Norway	0.6	0.0	0.2	1.0	0.6
Hungary	0.5	0.0	0.2	0.7	0.5
Czech Republic	0.5	0.0	0.0	0.2	0.7
Denmark	0.4	0.0	0.3	0.4	0.3
Luxembourg	0.3	0.0	0.2	0.1	0.3
Poland	0.2	0.6	0.7	0.3	0.2
Canada	0.2	0.0	0.0	0.3	0.2
Rest	1.0	1.2	0.8	1.0	1.0
Total Patents	32,264	162	2,061	7,761	22,280

Source: See Graph 1.

¹⁸ See Patricio Sáiz, "Patents, International Technology Transfer and Spanish Industrial Dependence, 1759-1878" in *Les chemins de la nouveauté: innover, inventer au regard de l'histoire*, dir. L. Hilaire-Pérez and A. F. Garçon, (Paris, 2003), 223-245, 233, Graph 1.

¹⁹ *Société Anonyme du Cuivre Français* (OEPM, *Privilegios* n. 5310, 5312, 5374, 5410); *Société du la Tonnellerie Mécanique* (OEPM, *Privilegio* n. 5328); *Les Forges et Fonderies de Montataire S. A.* (OEPM, *Privilegio* 5547); *Société Metallurgique d'Exploitation Méthode Ponsard* (OEPM, *Privilegio* n. 4934).

Far behind France, other countries with corporate patents before 1880 were Germany (11.1%), whose corporations were beginning their international expansion throughout Europe, especially after the unification in 1870, the United Kingdom (6.2%), Switzerland, Italy (3.1% each), Belgium and the US (1.2% each). All of this indicates a narrow international scope of patents and technologies before the 1870s-1880s, where technology transfers occurred through human capital shifts and direct investments abroad, still in a world where knowledge was embedded in the skills of workers and technicians, and where scientific education was universally scarce, especially in Spain.²⁰ In these circumstances, the transmission of that *useful and reliable knowledge*, as J. Mokyr has called it,²¹ was normal and directly driven by people with some kind of economic interest in the country who then might use the domestic patent system as a function of its strength or weakness in defending their businesses in court. This latter statement should be taken into account even in the twentieth century, when corporations captured the ‘international patent system’ on their way to technological globalization.

Nevertheless, if we attend to what is shown in Table 2, it is difficult to question the tremendous difference in the international scene from 1880s onwards. In the first period analyzed, firms from only a few key countries were represented, the main one being France, but only in the last twenty years of the nineteenth century that tendency had begun to change. First, by a radical decrease of French firms’ proportion of patents compared to those granted to corporations from Germany, the US, the UK, Belgium or Switzerland, which began to extend their ‘tentacles of progress’, in the words of David Headrick;²² and secondly by a diversification in the number of nations from which firms

²⁰ See Santiago Riera, “Industrialization and Technical Education in Spain 1850-1914” in Education, Technology and Industrial Performance in Europe, 1850-1939, eds. R. Fox and A. Guagnini (Cambridge, 1993), 141-170.

²¹ Joel Mokyr, The Gifts of Athena: Historical Origins of the Knowledge Economy, (Princeton, 2002).

²² Daniel R. Headrick, The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940 (New York, 1988).

applied for patents in Spain.²³ This means that companies located in Sweden, Austria and Hungary, the Netherlands, Norway, Denmark, Luxembourg, Poland and Canada (among many others grouped by ‘Rest’ in Table 2, with meagre proportion of grants) also began to patent lightly in the Spanish market after 1880. These two general biases remained during the first third of the twentieth century. German corporations became leaders, reaching around 30% of corporate patents in the entire period from 1900 to 1939, while France continuously fell from 34.6% between 1880 and 1889 to 17.1% in the 1920s and 1930s. Just as Germany did, the US constantly increased its presence in Spain, rising to 15.4% of corporate patents. The UK also grew to 15% (1900-1919) but then fell to 13.5% in the final period examined, as well as Belgium, whose firms patented in Spain at a rate of 6.5% in the late nineteenth century, decreasing later to merely 1.7%. The case of Swiss and Dutch firms is very interesting; they increased their patents until going beyond Italians between 1920 and 1939 (Switzerland 7.4%, the Netherlands 5.1% and Italy 3.5%). The rest of the countries registered just over 1% of patents each, but it still demonstrates how corporations had a similar international vocation everywhere.

Table 3. Foreign Corporations in Spain and Capital Investments (1780-1914).

	Firms (1780-1914)		Capital (1851-1914)	
	Nº	%	Thousands Euros	%
France	234	42.3	6,204.43	59.11
UK*	140	25.3	1,728.93	16.47
Germany	63	11.4	366.74	3.49
Belgium	45	8.1	656.91	6.26
Switzerland	16	2.9	28.49	0.27
Italy	14	2.5	10.10	0.10
USA	7	1.3	3.19	0.03
Rest**	34	6.1	1,497.36	14.27
TOTAL	553	100.0	10,496.14	100.0

²³ For a general view of the changes occurred in international patenting see: Ian Inkster, “Technology Transfer in the Great Climacteric. Machinofacture and International Patenting in World Development circa 1850-1914”, *History of Technology* 21 (1999): 87-106.

* In the UK figures 6 Irish enterprises are included; ***Rest* includes firms from The Netherlands, Canada, Norway, Sweden, Argentina, Austria (including Hungary) Czechoslovakia, Denmark, Mexico and Portugal.

Source: Teresa Tortella, A Guide to Sources of Information on Foreign Investment in Spain, 1780-1914 (Amsterdam, 2000), Tables 1 and 5, pp. xi and xix.

If we now focus on Table 3, which shows firms and capital invested in Spain by country of origin up until World War I, we can easily observe how the investment distribution matches the corporate patents, as industrial and intellectual property rights are nothing more than another investment abroad. In spite of the fact that the nations represented are virtually the same in both Tables ('Rest' included) and that France appears as the leading foreign investor, there are also some interesting differences. According to T. Tortella, France and the UK represented 68% of firms and 75% of capital investments, which fit well with the proportion of corporate patents before 1880 (taking into account that France completely predominated) but not afterwards, between 1880 and 1914, just when German patents increased. Notwithstanding, again according to Tortella, German real investments in Spain, compared with French and British ones, were apparently limited, as were those of the Swiss, Italian or especially Anglo-American, another country with increasing patent applications in Spain in the first two decades of the twentieth century.

All of this outlines some well-known fields in business and technological history, but it also raises new questions. Analyzing the Spanish patent system demonstrates, first, that before the 1880s, the international mobility of firms' capital, technology and patents was still rather limited, mainly related to those with direct investments in the Spanish economy or with interests around it. That led directly to France, whose firm's investments in Spain, patents included, reached a wide variety of sectors. To a lesser extent, companies from the UK, Germany, Switzerland or Italy were also represented. However, after 1880, German corporations began systematically to

extend their patent rights throughout Europe and America,²⁴ as did companies from the US and several other countries –newcomers to technological globalization- while the UK reached its ‘technological climacteric’. This does not necessarily mean an increase in direct capital investments from Germany or the US in the Spanish economy, according to Table 3.

What is sure is that inventions from Germany and the US massively arrived at almost all the patent systems of the North Atlantic economies, opening the door to what we have long called the second industrial revolution. This technological and entrepreneurial competition, in the framework of a scientific, economic and commercial struggle, resides within different patent strategies of corporations and multinationals from the most significant economies before World War I. But how can we interpret these data in light of the technological backwardness of Spain or other lagging nations? Why the increase in total corporate patenting after 1880 and especially from certain countries such as Germany, the US, the UK, Switzerland or the Netherlands? Does it mean that the process of technology transfer to Spain also grew in the same proportion or that it came first from France and then mostly from others? Were the frontiers of geographic proximity really changed, favouring technology transfer and technological globalization? These are not easy questions to answer without a detailed analysis of the administrative life of patents and especially without many case studies that obviously is not within the scope of this paper. Nevertheless, we can offer some clues to address the research agenda.

Thanks to the large body of work carried out over the last decade at the Archive of the Spanish Patents Office, we have been able to analyze the documentation of patents’ obligatory implementation, an interesting administrative requisite in Spain.

²⁴ On German chemical firms’ patent landing in the UK in the late nineteenth century see Ian Inkster, “Patents as Indicators of Technological Change and Innovation. An Historical Analysis of the Patent Data, 1830-1914”, *Transactions of the Newcomen Society* 73 (2003): 179-208, Table 8

Within a 1 to 3-year time frame²⁵ the firm was required to demonstrate that the patented object was being implemented within national territory, which was enforced to varying degrees depending on the period, always under penalty of expiration of the monopoly and, from 1924 on, also of a compulsory license to whoever applied.²⁶ Once the implementation requirements were met, another significant point was the duration of the patent, if we suppose that its greater length and cost was a consequence of reasonable expectation of profit from the monopoly²⁷. We obtained this information from the analysis of the initial and renovation fees met by the firm to maintain exclusive rights, which were paid in advance between 1826 and 1878 after choosing the expiration date (5, 10 or 15 years) and annually from 1878 onwards for a maximum of 20 years.²⁸

Table 4. Corporate Patents from Different Countries by Implementation and Duration percentages. Spain, 1820-1939.

	Implemented %	Non Implemented %	Implemented & Duration >5 y. %	Corporate Patents*
Germany	20.8	79.2	12.7	8,848
France	25.5	74.5	16.1	5,892
USA	22.0	78.0	13.6	4,242
UK	29.0	71.0	19.3	4,039
Switzerland	16.5	83.5	11.4	1,953
Netherlands	11.7	88.3	7.7	1,140
Italy	23.0	77.0	13.4	1,005
Belgium	31.4	68.6	12.4	725

²⁵ See note 6.

²⁶ From the beginning of the protection system until 1849, there was hardly any control over patent implementation, but a radical change introduced by a Royal Order that year (Royal Order of the 11th of January) precipitated an efficient control from 1849 to 1878, when notarized independent reports were required. Between 1878 and 1924 the implementation procedure was relaxed, being sufficient, in some cases, a report by an engineer certifying that the necessary means to produce an object existed at such-and-such a factory, but nonetheless it still was a difficult requisite to beat. In 1924 the Regulation of the 15th of January strengthened the practice clauses and required implementation under penalty, at first, of a forced compulsory license of the patent to whoever applied, and then, once passed the Law of the 26th of July of 1929, including an expiration date in 3 years if nobody took the license.

²⁷ The duration of the monopoly is used as a measure of patent value: see J. Streb, J. Baten and S. Yin, "Technological and Geographic Knowledge Spillover in the German Empire 1877-1918", *Economic History Review* 59 (2006): 347-373. They selected as German valuable patents all that survived at least ten years.

²⁸ Except for patents of introduction, which only lasted a maximum of 5 years although they were under the same requirements of compulsory implementation.

* Calculations were made based on 92.1% of patents analyzed. It is not possible to establish whether or not the remainder were implemented.

Source: See Graph 1.

As Table 4 clearly demonstrates, the great majority of corporate patents granted to foreign firms were never implemented, which means that an average of 77% expired within a maximum of 3 years and that its technological information became of public domain.²⁹ Moreover, if we search the fees paid out for those corporate patents that had legally proved implementation, roughly 14% lasted more than 5 years. Therefore, around 86% of foreign corporate patents were not exploited and of public domain in 5 or 6 years in Spain during the period studied. That suggests that firms and corporations internationally extended their patent rights as a common protection strategy, especially after 1880, regardless of the specific conditions of a particular patent system or a country, assuming that it fulfilled the minimum legal guarantees for registering and that its economic or technical position might offer some business opportunities. Yet, only on very few occasions patents actually turned into significant business whilst the majority expired within a short period of time. The networks of industrial and intellectual property agents, most of them lawyers and engineers, were increasingly responsible for these tasks of right extensions, payments, translations and adaptations of technical descriptions to each patent system and to distinct administrative requirements.³⁰ Some previous works have clearly demonstrated to what extent the descriptions of inventions changed in different patent systems and how firms and their agents toyed with administrative requirements to achieve legal protection on the one hand, but to reveal the minimum key technical information of novel inventions on the other, as occurred,

²⁹ The only exception is that between 1924 and 1929 a non-implemented patent did not expire if the patentee publicly offered a compulsory license. But after 1929 the firm had 3 years to put into practice, another 3 years for offering compulsory license and then the patent expired and the technological information became public. See note 26.

³⁰ See note 2.

for instance, when comparing Rudolf Diesel's Anglo-American, German, French, British and Spanish patents.³¹

What is also significant in analyzing Table 4 is how the percentage of corporate patents implemented varied depending on the country we focused on. It is true that corporations from Germany and the US increased their rhythm of patenting in Spain substantially after 1880, but Belgium, the UK and France, precisely the first three countries in total investments shown in Table 3, were the ones with more patent 'effectiveness' if we attend to the compulsory implementation (31.4%, 29% and 25.5% respectively). On the contrary, the US, Germany and especially Switzerland and the Netherlands were well below those percentages (from 22% of the US corporations to a discreet 11.7% in the case of Holland). More or less the same occurs when focusing on the patents' duration. The UK and France had higher rates of active patents after 5 years than firms from any other country represented in Table 4 (19.3 and 16.1%); the US, Germany and Belgium represented between 12 and 13% and Switzerland and Holland with even lower percentage points. Thus, although the differences do not seem radical, they are remarkable enough to point out that, even after 1880, during the second industrial revolution and the first technological globalization, geographic proximity and direct investments in Spain were still important to the point of effectively extending patents and transferring technologies.

Another interesting means of measuring the real impact of patents is the number of assignments and licenses registered during their lives, no matter how short or long the patents' duration was, as they could be considered an indirect proxy of technical quality of the invention protected, as well as of business interest as to innovation.

³¹ Each technical description was translated and adapted to each national patent system to fulfil the basic requirements. Analyzed by an expert engineer all those patents had lack of relevant technical information, which was a real problem in systems without previous examination. See Ruben Amengual, Bielas y álabes. Evolución histórica de las primeras máquinas térmicas a través de las patentes españolas, 1826-1914 (Madrid, 2008), 116-131.

Moreover, those legal transmissions could be the real object for some foreign firms patenting in Spain from abroad, insofar as they were not really interested in making actual investments in the Spanish economy but rather they needed national partners to maintain monopolies and get around compulsory implementation requirements. Thus, assignments and licenses could also teach us much about the corporations' international strategies concerning technology transfer and its real consequences.

Table 5. Corporate Patents from Different Countries by Percentage of Assignments & Licenses. Spain, 1820-1939.

	Assignments & Licenses %	Corporate Patents
Germany	6.2	9,585
France	5.4	6,354
USA	7.7	4,691
UK	7.0	4,406
Switzerland	3.9	2,120
Netherlands	7.6	1,226
Italy	4.9	1,079
Belgium	2.5	765

Source: See Graph 1.

Table 5 demonstrates once again the apparent scarcity of business around foreign corporate patents. Only a small percentage of them, around 6%, were officially assigned or licensed during the entire period studied, although there were rather interesting differences among countries. Companies from the US, the Netherlands, the UK or even Germany had higher licensing rates than Belgium, Switzerland, Italy or France. If we compare these ratios with those of implementation in Table 4, it is possible to establish a certain reverse relationship between them. A high level of implementation corresponds to a low one of assignments and licenses, such as the extreme cases of Belgium or the Netherlands. This general tendency can also be observed in the US, German, French and Italian examples, although not in those of the

UK and Switzerland, with high ratios of implemented patents and assignments corresponding to the former and low ones to the latter. Yet it seems acceptable to think that firms from countries with direct investments and worthy patents in practice might have had less interest in assigning or licensing a monopoly that gave them technological advantages for fighting competitors. On the contrary, if patenting was an international impetus from certain technical leaders, less implemented patents and more assignments or licenses would reveal more interest in the commercialization of property rights than in working the new innovations. These were two clearly different business strategies, which led to two distinct paths of technology transfer. Once again, case studies will be the only way to go into and test these processes.

4. Conclusion

Why did foreign corporations extend their patent rights to Spain and other peripheral countries after 1880? Were there really different protection strategies and, in case of the affirmative, which ones? What was the real role of patents in technology transfer and what were their consequences for backward nations? And, principally, what does it really mean to have a weak patent system? Was the Spanish one weaker than the Swiss or Dutch patent systems, which either did not exist or was abolished during certain significant periods to encourage imitation?³²

This contribution has uncovered sufficient data to be able to attempt to answer some of those questions and probably to raise new ones. We have seen that firms' patenting in Spain was scarce before 1880 and seemed to be closely related to the existence of direct interests or investments in the country and to geographic proximity.

³² Switzerland rejected patent laws until 1888. Holland rescinded it between 1869 and 1912. Also Denmark took advantage of no-existence of patent law to copy: See Petra Moser, "How do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fair", *American Economic Review* 95, 4 (2005): 1214-1236.

But from 1880 onwards, corporate patent activity increased everywhere in an expansive impetus driven by progressive technological globalization and international market competition led by Germany, the US and other newcomers. That patent expansion was not precisely correlated to the levels and direction of foreign investments in Spain. When patent implementations and property assignments are analyzed, the data confirm the limited impact of the majority of those supposedly strong monopolies obtained by foreign corporations. On average, more than 75% of corporate patents were extinguished and of public use in three years, a proportion that reached 85% in five years time, while no more than 6% seem to have been licensed within Spain. All these percentages tended to increase if the firm belonged to countries with less direct investments in the Spanish economy.

Therefore, the huge patent expansion in the late nineteenth century seems part of a first global and general strategy of international corporations, especially from Germany or the US but also France, the UK, Switzerland or The Netherlands who, whether or not they had clear intentions of investing, transferring or even licensing technologies in a particular country, registered and paid for exclusive rights in possible foreign markets. With the international generalization of the annual fee payments, it was probably cheaper and easier to first extend rights everywhere and then reflect on viable businesses throughout the following years, than to use time and energy in selecting countries which would be crucial to patent. This also meant assuming the risk of losing the right and making technological information public in some countries, but at least that might block similar patents from competitors. Industrial property agents and their networks were vital to this process.

Nevertheless, if a corporation had any interest in a country or a technology, it had to manage that intangible asset in some way. Extended case studies are needed to

see how major firms used patent strategies. Our work in progress is dealing with data from 100 corporations with more than 30 patents in Spain during the nineteenth century and the first half of the twentieth century. The most significant ones were from Germany or Holland with more than 500 patents, such as I. G. Farbenindustrie A. G., Fried. Krupp A. G. or N. V. Philips' Gloeilampenfabrieken, as well as others from the United Kingdom, France or Switzerland with more than 300 records, such as Vickers Ltd., Schneider et Compagnie, or Brown, Boveri et Compagnie and some from the US (with around 150 patents) such as the United Shoe Machinery Company or Westinghouse Electric & Manufacturing Company. The analysis we are carrying out will detail information of real patent strategies and technology management. We will only discuss some general ideas and examples here as to those series of tactics which, of course, depended on the previous investments, geographic proximity, industrial sector and the state of techniques and economy in the target country.

Table 6 clearly revealed two very different strategies followed by the selected corporations during the period analyzed. On the one hand, from 1905 onwards, the Swiss Brown Boveri et Compagnie automatically extended patents to Spain from the central headquarters in Baden but put into practice a low percentage of them (16%) in workshops belonging to temporary partners. Only 10% of those patents were still surviving after five years. On the other hand, Babcock & Wilcox Ltd., the English affiliate of the American Babcock, Wilcox and Company, registered approximately 30 patents between 1894 and 1918, the year in which a Spanish subsidiary was created, and from that moment on both registered numerous strong patents in Madrid, with a high ratio of implementation and a very long duration. Brown Boveri (B&B) and Babcock Wilcox (B&W) were strong multinationals insofar as they had affiliates and subsidiaries in other countries. B&B extended to Germany, France, Italy and Norway and the

German branch also patented in Madrid after 1930 with scant success if we observe the implementation and time-duration percentages in Table 6. It seems that the fact of not having a direct ally, subsidiary, affiliate or joint venture in Spain could have been an influence on the weak character of B&B's patents which had a high 'mortality' rate. Thus, most of the technology patented by B&B was public information in Spain within a few years after being protected. What would be really interesting is to find out how B&B managed patents and technology transfer in other countries where it was installed or had affiliates, such as in Germany.

On the contrary, B&W UK participated in the foundation of the Sociedad Española de Construcciones Babcock & Wilcox, which was established in Bilbao in 1918, and together with it they widely used and took advantage of the Spanish patent system. The creation of the Spanish section itself was made transferring patents from the English company as a share of the initial capital.³³ After that, both firms successfully patented technologies, putting into practice high percentages (66% in the case of the British and 82% in the case of the Spanish) and maintained approximately 46% the former and 68% the latter active after 5 years. Those are very significant percentages, to which we must add the noteworthy use of 'patents of introduction', which means copying and transferring technologies from third parties or competitors. The strategic links between both companies were evident. They registered the same number of patents, as if they had made a pact on tactics to manage technology transfers from the British to the Spanish subsidiary. They knew the Spanish system perfectly in order to use patents of introduction and to meet the compulsory working clauses on time, issues in which the local company was knowledgeable. Furthermore, all the

³³ OEPM, Patente n. 28,258. This file has the official documents by which the British B&B assigned several patents for the foundation of the Spanish affiliate.

assignments made by the British parent company (54% of the patents) were to the Spanish one.

As in the case of B&B, it would be critical to compare the Spanish strategy followed by the British B&W with that of other countries such as Germany or France, where there were also affiliates or subsidiaries, as well as with that of the US parent firm, which seemed to be far from the British dynamism, as Kristine Bruland has pointed out.³⁴ Notwithstanding, the American B&W used the same tactic of selling patent rights to the British company and taking a part of the shares when founded.³⁵ The B&W strategy in Spain implied real and durable monopolies on technology, whilst B&B quickly opened its technologies to public domain. Nevertheless, both strategies must be carefully evaluated in relation to the sort of inventions and innovations that were protected. It is not the same to operate with steam technologies and general mechanical construction, which could be easily copied towards the middle of the second industrial revolution even in countries such as Spain (which was able to manufacture their own locomotives, for instance, in 1884) as it is to work with complex new science-based technologies, such as electricity and electrical devices, which might not be so skilfully imitated by competitors. This is especially true in countries without a strong scientific and technical education and in patent systems without previous technical exams, which could produce a lack of vital scientific information, as we have demonstrated.³⁶

Thus, the role of patents in technology transfer seems to be complex. They could be a useful incentive where there were previous direct investments in the target nation,

³⁴ Kristine Bruland, "The Babcock & Wilcox Company: Strategic Alliance, Technology Development, and Enterprise Control, circa 1860-1900" in *From Family Firms to Corporate Capitalism. Essays in Business and Industrial History in Honour of Peter Mathias*, eds. K. Bruland and P. O'Brien (Oxford, 1998), 219-245.

³⁵ Id., *Ibidem*, 238.

³⁶ See note 31.

join ventures with local capital or any other dynamic agreements between domestic and foreign interests. Likewise, patents had a greater impact if they were accompanied by human capital from the country of origin in order to help technology transfer. In these cases they had very clear consequences in the backward nations, not only in relation to the opportunity of accessing new technologies, but also of improving their industrial development by the externalities linked to physical investments. It is true that patents and technology transfer could also yield technological dependence and loss of profits in favour of foreign partners, but undoubtedly local governments came to terms with that problem in order to promote industrial advancement and economic growth.

Last but not least, we should reflect on the final questions set out at the beginning of these concluding remarks. Was the Spanish patent system weak? Perhaps it was a feeble system, as was the entire National Innovation System, for encouraging domestic scientific or inventive activity. But that was not the principal political intention. On the contrary, it was a ‘hybrid’ patent system that, at the same time that it gave enough protection to those firms who really transferred technology and made investments in Spain, i.e. contributed to industrial transformations, it also determinedly punished patent activity not focused on actual transfers (by compulsory working clauses) or lack of interest in the country (by patents of introduction). Many other European States used similar strategies during the industrial revolution to facilitate technology transfers and imitations, from the wide use of patents of introduction and replicas everywhere, the UK included, to the real elimination of the patent law, as occurred in The Netherlands. Anything was valid for stimulating catching-up processes and to take advantage of innovation activity spillovers. The US itself used World War I to confiscate private German patents from chemical corporations, test and diffuse the

technical information protected and boost American competitors.³⁷ Previously, in the late nineteenth century, German machine-tool builders were widely copying the US manufacturers who publicly complained about it, just as nowadays German entrepreneurs protest against Chinese counterfeiting.³⁸ That is an old story to which patent management is also related. Chinese or Indian firms are supported by their governments in that game, but contemporary small backward countries cannot even play.

³⁷ Kathryn Steen, “Confiscation and the Challenge of Emulation: American Expertise and German Chemical Patents, 1914-1930”, *Patents in the Past*, *Maison des Sciences de l’Homme*, 23 September 2006 (unpublished). See also K. Steen “Confiscated Commerce: American Importers of German Synthetic Organic Chemicals, 1914-1929,” *History and Technology* 12 (1995): 261-284.

³⁸ Ralf Richter and Jochen Streb, “Catching-up and Falling Behind. Illegal Knowledge Spillover from American to German Machine Tool Makers”, *Center for Research on Innovation and Services, University of Hohenheim* (Stuttgart, 2009). Available at: <http://ideas.repec.org/p/zbw/fziddp/200909.html>

Table 6. Patent activity in Spain by Brown Boveri and Babcock Wilcox corporations (1878-1939).

Company's Name	Country	Patents: Principal Sector	Patents	Of introduction %	Implemented %	Implemented & Duration >5 y. %	Assignments & Licenses %
Brown, Boveri et Compagnie	Switzerland	Electricity	282	1.4	16.0	10.3	0.4
Brown Boveri & Cie. A. G.	Germany		28	0.0	3.6	3.6	0.0
Babcock & Wilcox Ltd.	UK		94	22.3	66.3	46.5	54.3
Sociedad Española de Construcciones Babcock & Wilcox	Spain	Steam Boilers, Furnaces, etc.	94	21.3	81.7	68.3	0.0
Deutsche Babcock & Wilcox Dampfkessel-Werke A. G.	Germany		1	0.0	0.0	0.0	0.0
Société Française des Constructions Babcock & Wilcox	France		1	0.0	100.0	100.0	100.0
The Babcock & Wilcox Tube Company	USA		1	0.0	0.0	0.0	0.0

Source: See Graph 1.